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AIR TRANSPORTATION ANALYSIS

ENVIRONMENTAL PROTECTION AGENCY

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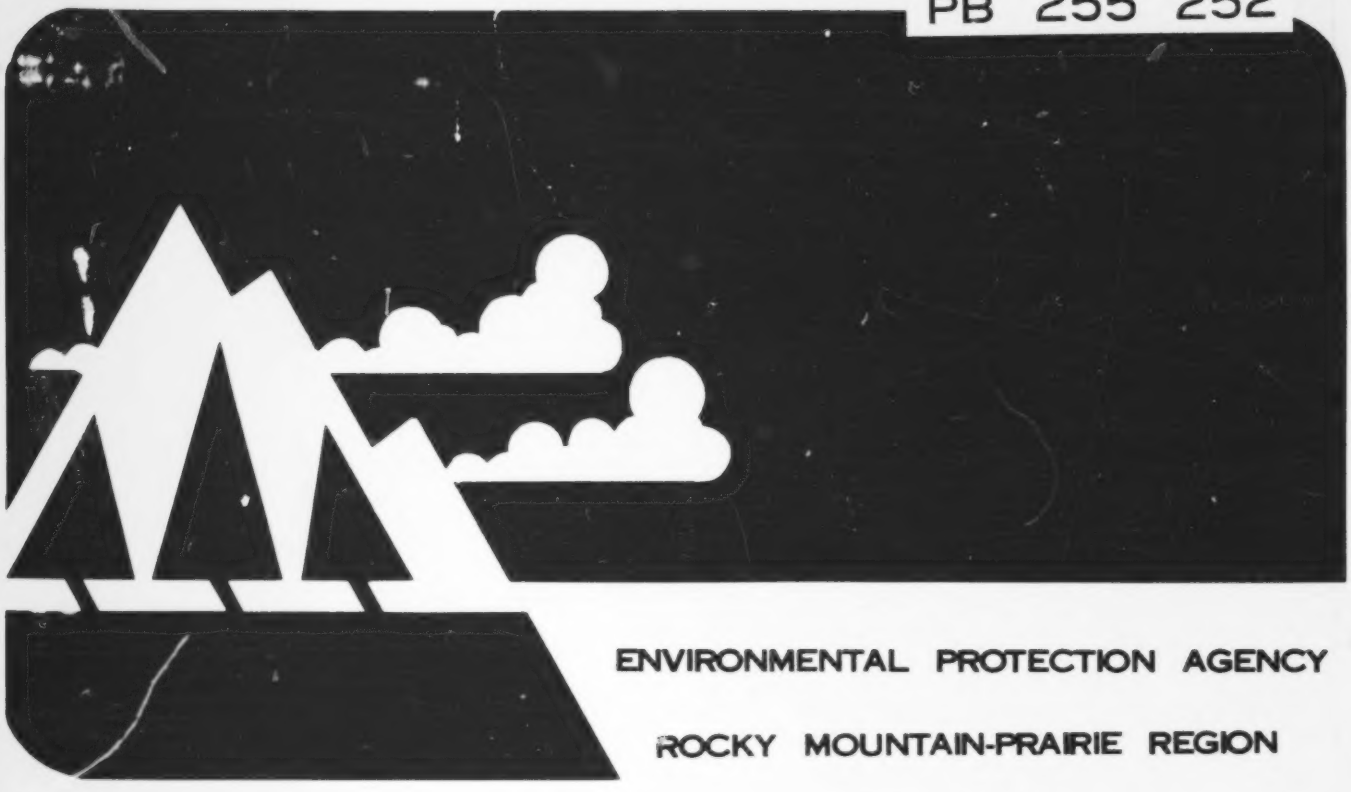

ENVIRONMENTAL PROTECTION AGENCY

ROCKY MOUNTAIN-PRAIRIE REGION

REGION VIII

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AIR TRANSPORTATION ANALYSIS

OCTOBER 24, 1972

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The intent of this study was to conduct an in-depth analysis of last year's air travel activities, including total miles flown, number of persons traveling together, passenger vs. other support travel activities, total cost, etc. and project Region 8 travel requirements into Fiscal Year 1973 and Fiscal Year 1974. This analysis was then contrasted against the cost-effectiveness of five types of aircraft of similar performance capability to determine if a cost savings, taking into account increased productivity on part of Region VIII staff, could be achieved.

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AIR TRANSPORTATION ANALYSIS

REGION VIII

Environmental Protection Agency

October 24, 1972

AIR TRANSPORTATION ANALYSIS

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SECTION 1

Summary

1.1 Statistics for FY-73

Distance (836,398 miles)

- Region VIII personnel will fly 536,398 miles to the 10 major cities within the Region
- Region VIII personnel will fly approximately 100,000 additional miles to other cities within the Region
- Region VIII personnel will fly approximately 200,000 additional miles to cities outside the Region

Total Cost ($89,284 Actual - $172,734 "Real"[1])

- 10 major cities in Region

  Actual - $59,084
  "Real" - 132,134

- Other cities in Region

  Actual - $10,100
  "Real" - 20,500

- Cities outside Region

  Actual - $20,100
  "Real" - 20,100*

*Days lost due to scheduling is minimal

Cost Per Mile

- Average actual cost per person per air mile $ .10
- Average "real" cost per person per air mile $ .21

1.2 Statistics on 10 Major Cities

- FY-72

  Actual Cost: $39,360.00

  "Real" Cost: $87,810.00

  Miles: 357,006

- FY-73

  Actual Cost: $ 59,084.00

  "Real" Cost: $132,134.00

  Miles: 536,398

- FY-74

  Actual Cost: $ 80,568.00

  "Real" Cost: $183,738.00

  Miles: 731,476

- Average actual cost per air mile: 10.1¢

- Average "real" cost per air mile: 20.5¢

[1] Actual cost includes only fares. "Real" cost includes fares plus a value for loss of productivity computed at $100 per man-day. It does not include the associated costs of per diem, salary benefits etc. paid during periods of non-productivity.

1.3 Cost Statistics

Operating Costs (Passenger Seat/Mile)

	7 seats	6 seats	5 seats	4 seats	3 seats
MU 2G	.033	.038	.046	.057	.076
King Air	.036	.042	.050	.063	.084
MU 2F		.035	.042	.052	.070
421		.026	.328	.041	.054
414		.023	.028	.035	.0473

COSTS PER YEAR

	(177,000 mi/yr) MU-2G	(152,400 mi/yr) King Air	(186,000 mi/yr) MU 2F	(144,000 mi/yr) 421	(134,400 mi/yr) 414
Operations*	41,124	39,372	41,124	29,094	23,451
Pilot Cost	23,000	23,000	23,000	23,000	23,000
Procurement**	46,605	39,648	39,962	22,486	17,421
Total	110,729	102,020	104,086	74,580	63,872

*600 hrs/yr

**Avg. cost over 12 yr. period

Section 2.0

Conclusion

The intent of this study was to conduct an in-depth analysis of last year's air travel activities, including total miles flown, number of persons traveling together, passenger vs. other support travel activities, total cost, etc. and project Region VIII's travel requirements into Fiscal Year 1973 and Fiscal Year 1974. This analysis was then contrasted against the cost-effectiveness of five types of aircraft of similar performance capability to determine if a cost savings, taking into account increased productivity on part of Region VIII staff, could be achieved.

There were several assumptions which were made in arriving at the conclusion of the aircraft strategy report. They are as follows:

(1) Increased productivity as it relates to minimizing working days lost due to poor availability of commercial aircraft and effectiveness as it relates to oil and toxic material spills, other surveillance activities and enforcement was our first priority; cost savings second; and better efficiency third were the principal factors in our analysis.

(2) Travel outside our Region would not be included in our analysis even though it represents 24% of the travel and may provide some cost savings. This assumption was made due to OMB Circular A-76, "Policies for Acquiring Commercial or Industrial Products and Services for Government Use", which discusses criteria which may conflict with commercial enterprises of private industry.

(3) At least two passengers would be included on all flights with an estimated average of three persons accompanying all flights within the region.

(4) The analysis would only provide the basis for determining that specific aircraft availability would be advantageous to Region VIII and not attempt to specify the type of aircraft best suited for our purposes, the institutional arrangement for operating and maintaining the aircraft or to provide the specific rationale for EPA to "own" or operate aircraft.

Based on our travel analysis and assumptions made above, the FY-73 projections indicate that Region VIII personnel, if utilizing commercial air transportation, would fly a total of 636,398 miles at an actual cost of $69,184 and a "real" cost of $152,634.00 or breaking this into cost per seat mile -- 10.8¢ actual and 23.9¢ "real."

Equating this to private aircraft utilization, assuming at least three passengers were on each flight, it would mean that 212,132 airplane miles would be required to satisfy most of our travel requirements within the region or between 600 and 800 flight hours a year depending on the type of aircraft. If 600 hours is used as a basis for determining cost per year, the total cost would range from $63,872.00 to $110,729.00 which is far below the $152,634.00 actually projected for Fiscal Year 1973.

With this result, Region VIII under all possible cost conditions would benefit by utilizing a private aircraft.

Greater cost savings could be achieved if further study was made on savings achieved through utilization of government aircraft hangers and optimizing fuel costs ($.40 commercial vs. $.19 government).

SECTION 3.0

Recommendations

There are several recommendations which can be made at this time:

(1) Contact General Counsel's office at headquarters to determine the legal status of EPA's authority to own and operate an aircraft.

(2) If necessary, develop an agency position paper for the Office of Management and Budget outlining the beneficial uses and cost effectiveness of EPA, under certain conditions, to own and operate an aircraft.

(3) Request the General Services Administration to determine the feasibility of having GSA

(a) Obtain an aircraft to meet our requirements,

(b) Permanently assign it to Region VIII,

(c) Pay all bills for gas, oil, lube, hanger, over-haul, etc.,

(d) Charge EPA-Region VIII for the above plus service charge.

(4) Conduct a detailed study to determine the specific aircraft capability required to meet Region VIII's requirements. This would include not only performance trade-offs versus cost, but trade-offs relating to obtaining and maintaining aircraft in the Denver area.

(5) Continue to utilize charter aircraft under the GSA "Tender of Service for Chartered Air Taxis" wherever it is in the best interest of the Federal government. It should be pointed out, however, that a cost saving of approximately 66 percent can be obtained by utilizing the U.S. Forest Service aircraft over comparable commercial aircraft.

SECTION 4

Situation

4.0 The program activities of this agency require frequent travel to the six states within Region VIII. The vast area of this Region requires that most of the travel be done by air. This travel not only involves employee travel but sampling and monitoring equipment relating to our surveillance and enforcement activities. Sparsely populated industrial areas with inadequate or nonexistent air transportation requires several modes of transportation to get to the final destination. The comprehensive nature of the operating programs requiring various expertise necessitate at least two to three people on the average flight. In several instances as many as nine EPA employees were required for a single one day meeting.

4.1 Scheduling and Costs

Commercial airlines operating within Region VIII do not schedule regular, daily flights to cities that Region VIII EPA representatives must often visit on official government business. Government time is wasted because personnel must often wait until the late afternoon hours of the day following a meeting to return to Denver. In order to avoid this, necessary and essential discussions or meetings with state representatives would have to be, and sometimes are, cut short. Late afternoon flights to Denver from other cities are scheduled, if at all, to arrive in Denver after normal working hours; so, if a

meeting or the traveler's duty ends early, he still cannot return to Denver until after the close of business. Furthermore, it is often necessary for Region VIII EPA representatives to leave early in the day before a meeting is scheduled in order to arrive in time for that meeting.

Examples of commercial airline service in Region VIII to the major cities within the region are listed below.

1. Denver to Pierre, S.D. - one scheduled flight.

The only flight leaves Denver at 7:00 AM and arrives in Pierre at 10:39 AM. It is very difficult to conduct delicate but precise discussions or negotiations within the time frame allowed by this flight and the return flight to Denver, listed on page 2.

2. Pierre to Denver - one scheduled flight.

This flight leaves Pierre at 5:10 PM and arrives in Denver at 5:58 PM. Since the Denver to Pierre flight arrives in Pierre at 10:39 AM, any contact, meeting or presentation could not begin until after 11:00 AM (driving time from the airport to Pierre is from 20 to 30 minutes); and, since the traveler must leave by 4:30 PM to catch the 5:10 flight to Denver, only four and 1/2 hours is available for business if one hour is taken for lunch. This time is obviously inadequate to make appropriate presentations or to discuss substantive matters, and an EPA representative is also obligated, in the interest of

good relations, to maintain effective EPA-state liaison by making contact with many, if not all, state governmental units. Because of the time of arrival in Pierre, two days, at the least, are thus consumed; and if less time is required, the traveler must still wait for the 5:10 PM flight to return. Arrival in Denver is after the time of the close of business.

3. Denver to Bismarck, N.D. - two flights scheduled.

One flight leaves Denver at 11:30 AM, and arrives in Bismarck at 2:21 PM: the other departs from Denver at 8:25 PM and arrives in Bismarck at 11:16 PM. The former flight does not allow enough time in Bismarck to conduct business of substantive nature. The latter is adequate, but requires an over-night stay.

4. Bismarck to Denver - two flights scheduled.

Flights leave Bismarck at 6:25 AM and 4:20 PM, and arrive in Denver at, respectively, 7:17 AM and 5:15 PM. Essential business often lasts past 4:00 PM (driving time to the airport is 20-30 minutes), necessitating another overnight stay.

5. Denver to Helena, Mont. - connections required at Great Falls, Mont.

Five flights leave Denver to Great Falls throughout the day; however, the only flight from Great Falls to Helena is at 2:40 PM, which arrives in Helena at 3:30 PM, too late to conduct any important business. The latest

a traveler can leave Denver to make the 2:40 PM connection in Great Falls to Helena is 11:25 AM. If the 11:25 AM flight cannot be taken, because of other business, the traveler must stay overnight in Great Falls and take the 2:40 PM flight to Helena the following day. In either case, no great degree of business can be conducted in Helena on the day of arrival, because of the time of arrival (3:03 PM); and, because of the departure time from Helena to Great Falls, explained below, two to four days are required to conduct one day of business.

6. Helena to Denver - connections required at Great Falls.

One flight leaves Helena to Great Falls. It leaves Helena at 2:00 PM, and arrives in Great Falls at 2:22 PM. Two flights leave Great Falls for Denver after 2:22 PM, and both arrive in Denver after the close of business. Seldom can the traveler on official business satisfy his duties within the time available - 5 hours - in the space of two days. Since the arrival time in Helena is 3:03 PM, the most time available on the day of arrival is 1½ hours; and, since the only flight out of Helena is at 2:00, only 3½ hours is available the following day if one hour is taken for lunch. Thus, the traveler requires, at a minimum, three days to satisfy his duties in Helena.

Similar situations are encountered if connections are made in Missoula, Montana or Billings, Montana.

The airline schedules outlined above for each of the three cities results in unnecessary expenditure of employee time. Furthermore, the schedules do not allow for delays due to the climactic conditions of the region.

Because of the commercial airline service outlined above, a considerable amount of money is spent for otherwise unnecessary lodging and per diem costs and miscellaneous expenditures are also increased. Thus, Region VIII EPA reliance on unsatisfactory commercial airline service results in increased cost to the Government in addition to wasted employee time.

Additional cost to the Government is, of course, caused by the commercial airline fares and charter fares. Round trip fares to some of the major cities in the region are listed below.

1. Pierre.....$ 76.00	6. Missoula.....$142.00
2. Bismarck.....$110.00	7. Gilette.....$ 72.00
3. Fargo.....$110.00	8. Sheridan.....$ 72.00
4. Casper.....$ 54.00	9. Billings.....$ 82.00
5. Helena.....$138.00	10. Salt Lake City....$ 96.00

The substantial number of trips within the region places an undue administrative burden on Support Services and Management, as well as on the rest of the EPA because of time consumed filling out GTR's, travel authorizations and travel vouchers, and their subsequent audit. Less time would be required if commercial airlines were not used.

The Region VIII EPA must often charter aircraft for routine and emergency surveillance and analysis. A conservative estimate of charter fares is $125 per hour of flight time. If surveillance and analysis requires 150 hours of flight time annually, the annual charter fare would be $18,750.

The following are the approximate flight times from Denver to the cities listed in Part I for each of the aircraft.

Denver to Pierre; 350 air miles

MU-2G (325 mph): 1¼ hrs.

MU-2F (340 mph): 1 hour

King Air (250 mph): 1½ hrs.

Cessna 421 (270 mph): 1¼ hrs.

Cessna 414 (252 mph): 1½ hrs.

Denver to Bismarck; 500 air miles

MU-2G (325 mph): 1 3/4 hrs.

MU-2F (340 mph): 1½ hrs.

King Air (250 mph): 2 hrs.

Cessna 421 (270 mph): 2 hrs. or less

Cessna 414 (252 mph): 2 hrs.

Denver to Helena; 575 air miles

MU-2G (325 mph): 1 3/4 hrs.

MU-2F (340 mph): 1 3/4 hrs. or less

King Air (250 mph): 2¾ hrs

Cessna 421 (270 mph): 2 hrs.

Cessna 414 (252 mph): 2¼ hrs.

If only five flights a month are made to each of the three cities, the range in annual flight times for each city is: Denver to Pierre, 60 - 90 hours; Denver to Bismarck, 90 - 120 hours; Denver to Helena, 105 - 136 hours. The sum of these figures yields a collective annual total of 255 - 346 hours and, when these sums are doubled to account for the return trip to Denver, the final projected flight hours to only these three cities and the return to Denver is 510 - 692 flight hours.

Listed below are the commercial airline flight times to each city.

Denver to Pierre: 3 hours, 21 minutes; return: 48 minutes.

Denver to Bismarck: 2 hours, 51 minutes; return: 50 minutes.

Denver to Helena:

1. Denver to Great Falls: 2 hrs. 44 minutes
2. Great Falls to Helena: 23 minutes

Return

1. Helena to Great Falls: 22 minutes
2. Great Falls to Denver: 2 hrs. 2 minutes

On the same basis of five flights a month to each city, the annual flight time to each city from Denver, including the return, is: Denver to Pierre, 249 flight hours; Denver to Bismarck, 221 hours; Denver to Helena, 307 hours. The projected annual flight hours to only these three cities and the return, using commercial airlines, is 777 hours - a difference of 85 to 267 flight hours from the annual flight time, depending on which aircraft is used, that is listed above. In terms of working days, EPA's nonreliance on commercial airline service would translate into 10½ - 33½ fewer working days spent traveling by air to these cities. Since two extra days are required to be spent in Pierre for one day of business, on the basis of five trips a month,

120 extra days are required annually; and, in Helena, since three extra days are required for one day of business, on the basis of five trips a month, 180 extra days are required annually. The working days that would thus be saved if EPA had its own aircraft would be 310½ to 333½ days a year. Again, this figure does not include the many trips EPA must make to other cities or the many other days lost because of inclement weather that often strands EPA personnel in other cities. Such loss of time could be substantially avoided if EPA did not have to rely on airline schedules that force EPA representatives to spend an undue amount of time waiting for flights in destination cities or connecting cities.

The Region VIII EPA's reliance on commercial airlines thus results in the waste of valuable government time and money, and also hampers the efficient conduct of EPA business. Other government business suffers as a result of the time that must be spent on business outside of Denver. This is especially true in the case of the Regional Administrator, his assistants, and the Deputy Regional Administrator, who must reserve several days to satisfy business requirements outside of Denver.

EPA aircraft would resolve this problem, allowing EPA personnel to arrive in a city outside of Denver on

the day of a meeting, and to leave as soon as his or her business is finished. Lodging, miscellaneous, and per diem expenses would thus be reduced or eliminated.

The figures in Appendix A are yearly projections based on the trips so far taken by EPA personnel during the first months or the initial phase of the Region VIII EPA operations.

During this period, initial legislative mandates were being explored by the EPA. Even at this time, present legislative authority and direction is not fully realized by the EPA because of the novelty and fledgling status of pollution abatement and control efforts in the U.S. As the EPA becomes increasingly aware of its enforcement authorities and the other tools it possesses for pollution prevention, and as it continues to identify the large number of specific pollution problems, travel to cities and localities within Region VIII will necessarily increase for purposes of surveillance and analysis, EPA-state liaison, discussions and negotiations, and briefings.

Furthermore, it is expected that Congress will grant the EPA more legislative authority and a greater amount of money than heretofore; and, thus, direct it to become concerned with a broader range of pollution problems and

prevention than presently. At the same time, the EPA will grow in size; that is, more personnel will be hired to perform additional duties delegated to the EPA by Congress. Some degree of travel must be expected to effectively discharge such duty.

Region VIII travel, for the reasons outlined above, can thus be expected to increase, using a conservative estimate, 1½ times during the '73 fiscal year; and, to double during the '74 fiscal year. The costs and lost employee work time delineated for the past months of the EPA's operations will increase accordingly because of the Region VIII EPA's reliance on inadequate and inconvenient commercial airline service.

4.2 Alternate Uses

1. Airborne surveillance and analysis.

2. Airborne inspection or tour for state government representatives, state legislators, or industrial representatives in order to illustrate, respectively, the need for industrial initiative in specific cases of pollution; or, in the cases of the states and industry, the reason(s) for EPA enforcement or regulatory action.

3. Airborne inspection or tour for media.

4. Airborne inspection or tour for other regions' representatives.

5. Equipment transport.

   a. Demonstration of equipment to state governmental units.

   b. Demonstration of equipment to industry.

   c. Transport of EPA equipment for monitoring of pollution.

   d. Transfer within a state of state equipment from one area to another (EPA assistance to state pollution monitoring efforts).

6. Emergency episodes.

   a. Oil spills

   b. Natural disasters

   c. Toxic and hazardous material spills

7. Transportation for field studies and inspections in specific areas.

   a. For EPA personnel

   b. For press, to draw public attention

   c. For state government

   d. For state legislators

   e. For EPA representatives from other regions, National office.

8. Transportation for staff, EPA representatives to regional meetings, state meetings, legislative briefings, seminars, symposia, and meetings outside Region VIII.

4.3 Pilot Costs

The Federal Government employs pilots in a wide range of capacities. The Aircraft Operations Series

GS-2181 includes positions of (a) pilots and copilots of airplanes and helicopters; (b) flight instructors and various kinds of staff specialists when the work requires primarily the application of airplane or helicopter pilot knowledge, skills and abilities.

Specific qualification standards for Federal Government employees are included in Appendix D. Position descriptions for pilots operating under flying conditions known to Region VIII are included in Appendix E. In the cost analysis $23,000 per year was used as a gross planning figure. This figure would include salary benefits and possible overtime.

4.4 Aircraft Factors

Factors which must be considered to satisfy travel requirements are as follows:

A. MU-2G

1. General Specifications

   a. 8-10 places, maximum of 14 places.

   b. Baggage compartment: 38 feet.

   c. Twin engine, turbo-prop (reversible props).

   d. Weight

      1. Empty weight: 6,700 lbs.
      2. Useful load: 4,100 lbs.
      3. Maximum take-off weight: 10,800 lbs.

(MU-2G Cont.)

2. Performance

a. Maximum cruising speed: 325 mph.

b. Rate of climb at sea level.

1. Twin engine: 2,590 fpm.
2. Single engine: 725 fpm.

c. Service ceiling

1. Twin engine: 27,000 ft.
2. Single engine: 11,600 ft.

d. Maximum range at 23,000 ft. with 30 minutes reserve: 1,550 miles.

e. Short-field capability.

1. Take-off distance over 50 ft. obstacle at 10,800 lbs: 1,890 ft.
2. Landing distance over 50 ft. obstacle at 8,620 lbs: 1,670 ft.

3. Purchase factors

a. Suggested list price: $469,950.00

b. Avionics

1. Collins Avionics Package: $98,200.00
2. King Avionics Package: $77,920.00

c. Accessories

1. Strobe lights (three): $996.00
2. Executive table (one): $399.00

d. Estimated total purchase cost.

1. With Collins Avionics: $569,545.00
2. With King Avionics: $559,265.00

B. MU-2F

1. General Specifications.

a. 6-9 places.

b. Baggage compartment: 31.3 feet.

c. Twin engine, turbo-prop (reversible props).

d. Weight

1. Empty weight: 5,790 lbs.
2. Useful load: 4,130 lbs.
3. Maximum take-off weight: 9,920 lbs.

2. Performance

a. Maximum cruising speed (8,730 lbs.): 340 mph at 23,000 ft.

b. Rate of climb at sea level (8,730 lbs.).

1. Twin engine: 2,875 fpm.
2. Single engine: 920 fpm.

c. Service ceiling (8,730 lbs.).

1. Twin engine: 30,400 ft.
2. Single engine: 14,800 ft.

d. Maximum range at 23,000 ft. with IFR reserves: 1,640 miles.

e. Short-field capability.

1. Take-off distance over 50 ft. obstacle at 9,920 lbs: 1,700 ft.
2. Landing distance over 50 ft. obstacle at 7,740 lbs: 1,320 ft.

3. Purchase factors

a. Suggested list price: $379,950.00

b. Avionics

1. Collins Avionics Package: $98,200.00
2. King Avionics Package: $77,920.00

c. Accessories.

1. Strobe lights (three): $996.00
2. Executive table (one): $399.00

d. Estimated total purchase costs.

1. With Collins Avionics: $479,545.00
2. With King Avionics: $469,265.00

C. King Air C90

1. General Specifications

   a. 6-10 places

   b. Baggage compartment: 26.5 cu. ft.

   c. Twin engine, turbo-prop (reversible props)

   d. Weight

      1. Empty weight: 5,581 lbs.
      2. Useful load: 4,069 lbs.
      3. Maximum take-off weight: 9,650 lbs.

2. Performance

   a. Maximum cruising speed: 250 mph (21,000 ft)

   b. Rate of climb at sea level (9,650 lbs.)

      1. Twin engine: 2,000 fpm.
      2. Single engine: 555 fpm.

   c. Service ceiling (9,650 lbs.)

      1. Twin engine: 25,600 ft.
      2. Single engine: 14,100 ft.

   d. Maximum range at 21,000 ft. with 45 minute reserve: 1,446 miles

   e. Short-field capability

      1. Take-off distance over 50 ft. obstacle at 9,650 lbs: 2,180 ft.
      2. Landing distance over 50 ft. obstacle at 9,168 lbs: 1,340 ft.

3. Purchase factors

   a. Suggested list price: $460,150.00

   b. Avionics

      1. Collins Avionics Optional Package: $13,210.00

c. Accessories

1. Strobe lights (three): $1,815.00
2. Executive table (one): $605.00

d. Estimated total purchase cost: $475,780.00

D. Cessna 421

1. General Specifications

a. 6-10 places

b. Baggage allowable: 1,340 lbs.

c. Twin engine, turbo-prop.

d. Weight

1. Empty weight: 4,409 lbs.
2. Useful load: 3,041 lbs.
3. Maximum take-off weight: 7,450 lbs.

2. Performance

a. Maximum cruising speed (7,450 lbs.): 270 mph (25,000 ft)

b. Rate of climb at sea level (7,450 lbs.)

1. Twin engine: 1,850 fpm.
2. Single engine: 305 fpm.

c. Service ceiling (7,450 lbs.)

1. Twin engine: 31,100 ft.
2. Single engine: 13,000 ft.

d. Maximum range at 25,000 ft., no reserve: 1175 miles (7,450 lbs.)

e. Short-field capability

1. Take-off distance over 50 ft. obstacle at 7,450 lbs.: 2,507 ft.
2. Landing distance over 50 ft. obstacle at 7,450 lbs.: 1,320 ft.

3. Purchase factors

a. Suggested list price: $197,900.00

b. Avionics

1. "400 Series": $15,060.00
2. "800 Series": $28,630.00

c. Avionics options

1.	800 Nav-O-Matic	$12,400.00
2.	Omni and ILS Approach Coupler	$ 2,115.00
3.	Heading Preselect	$ 555.00
4.	Vacuum Slaved Directional Gyro	$ 1,135.00
5.	400 Transponder	$ 2,935.00
6.	800 DME	$ 5,490.00
7.	AVQ-47 (X Band) Weather Radar	$ 9,305.00
	Total	$34,135.00

d. Accessories

1.	Strobe lights (three)	$ 1,210.00
2.	Air conditioning	$ 6,720.00
3.	Executive table	$ 365.00
4.	Toilet	$ 875.00

e. Estimated total purchase cost

1. With "400 Series" Avionics: $256,265.00
2. With "800 Series" Avionics: $269,835.00

E. Cessna 414

1. General Specifications.

a. 6-7 places

b. Baggage allowable: 930 lbs.

c. Twin engine, turbo-prop

d. Weight

1. Empty weight: 4,039 lbs.
2. Useful load: 2,311 lbs
3. Maximum take-off weight: 6,350 lbs.

2. Performance

a. Maximum cruising speed (6,350 lbs.): 252 mph at 25,000 ft.

b. Rate of climb at sea level (6,350 lbs.)

1. Twin engine: 1,580 fpm.
2. Single engine: 240 fpm.

c. Service ceiling (6,350 lbs.)

1. Twin engine: 30,100 ft.
2. Single engine: 11,350 ft.

d. Maximum range at 25,000 ft., no reserves: 796 miles (6,350 lbs.)

e. Short-field capability

1. Take-off distance over 50 ft. obstacle at 6,350 lbs.: 2,350 ft.
2. Landing distance over 50 ft. obstacle at 6,350 lbs.: 1,865 ft.

3. Purchase factors

a. Suggested list price: $153,500.00

b. Avionics

1. "400 Series": $15,060.00
2. "800 Series": $28,630.00

c. Avionics options

1.	800 Nav-O-Matic	$12,400.00
2.	Omni and ILS Approach Coupler	$ 2,115.00
3.	Heading Preselect	$ 555.00
4.	Vacuum Slaved Directional Gyro	$ 1,135.00
5.	400 Transponder	$ 2,935.00
6.	800 DME	$ 5,490.00
7.	AVQ-47 (X Band) Weather Radar	$ 9,305.00
	Total	$33,935.00

d. Accessories

1.	Strobe lights (three):	$1,210.00
2.	Air conditioning:	$6,280.00
3.	Executive table (one):	$ 365.00
4.	Toilet:	$ 895.00

e. Estimated total purchase cost

1. With "400 Series" Avionics: $198,833.00
2. With "800 Series"Avionics: $212,403.00

APPENDIX A

ANALYSIS OF TRAVEL TO TEN MAJOR CITIES

CITY	TRIPS	FARE	DAYS LOST	COST DAYS LOST	TOTAL ACTUAL COST	TOTAL "REAL" COST	COST/AIR MILE ACTUAL	COST/AIR MILE "REAL"	TOTAL AIR MILES
Pierre		($76/trip)		(100/day)			(700 miles)		
FY-72	57	4332	114	11,400	4,332	15,732	.10	.39	39,900
FY-73	86	6536	172	17,200	6,536	23,736			60,200
FY-74	144	10,944	288	28,800	10,944	39,744			100,800
Bismarck		($110/trip)		(100/day)			(1000 miles)		
FY-72	51	5,610	102	10,200	5,610	15,810	.11	.31	51,000
FY-73	77	8,470	154	15,400	8,470	23,870			77,000
FY-74	102	11,220	204	20,400	11,220	31,620			102,000
Fargo		($110/trip)		(100/day)			(1000 miles)		
FY-72	20	2,200	20	2,000	2,200	4,200	.11	.21	20,000
FY-73	30	3,300	30	3,000	3,300	6,300			30,000
FY-74	40	4,400	40	4,000	4,400	8,400			40,000
Helena		($114/trip)		(100/day)			(1150 miles)		
FY-72	75	8,550	225	22,500	8,550	31,050	.09	.36	86,250
FY-73	113	12,882	339	33,900	12,882	46,782			129,950
FY-74	150	17,100	450	45,000	17,100	62,100			172,500
Missoula		($142/trip)		(100/day)			(1500 miles)		
FY-72	29	4,118	7	700	4,118	4,818	.09	.11	43,500
FY-73	44	6,248	11	1,100	6,248	7,348			66,000
FY-74	58	8,236	17	1,700	8,236	9,936			87,000
Gilette		($72/trip)		(100/day)			(650 miles)		
FY-72	16	1,152	16	1,600	1,152	2,752	.11	.26	10,400
FY-73	24	1,728	24	2,400	1,728	4,128			15,600
FY-74	32	2,304	32	3,200	2,304	5,504			20,800

con't

CITY	TRIPS	FARE	DAYS LOST	COST DAYS LOST	TOTAL ACTUAL COST	TOTAL "REAL" COST	COST/AIR MILE ACTUAL	COST/AIR MILE "REAL"	TOTAL AIR MILES
Sheridan		($72/trip)		(100/day)				(756 miles)	
FY-72	9	648	.5	50	648	698	.09	.10	6,804
FY-73	10	720	.5	50	720	770			7,560
FY-74	12	864	.7	70	864	934			9,072
Salt Lake City		($96/trip)						(700 miles)	
FY-72	113	10848	0	0	10,848	10,848	.13	.13	79,100
FY-73	170	16,320	0	0	16,320	16,320			119,000
FY-74	226	21,696	0	0	21,696	21,696			158,200
Casper		($54/trip)						(520 miles)	
FY-72	17	918	0	0	918	918	.10	.10	8,840
FY-73	26	1404	0	0	1404	1404			13,520
FY-74	34	1836	0	0	1836	1836			17,680
Billings		($82/trip)						(976 miles)	
FY-72	12	984	0	0	984	984	.08	.08	11,212
FY-73	18	1476	0	0	1476	1476			17,568
FY-74	24	1968	0	0	1968	1968			23,424

APPENDIX B

COMPLETE AIRLINE SCHEDULE

To: Fargo, North Dakota From: Denver, Colorado

Flights have been discontinued

To: Denver, Colorado From: Fargo, North Dakota

Flights have been discontinued

To: Missoula, Montana From: Denver, Colorado

5:40p	11:43p	FL	520	S	C5	6	$142.00

To: Denver, Colorado From: Missoula Montana

Flights have been discontinued

To: Cheyenne Wyoming From: Denver, Colorado

11:00a	11:30a	FL	522	S	C5	0	
5:40p	6:10p	WA	52	Y	737	0	
8:00p	8:32p	FL	948	S	B9	0	$36.00

To: Denver, Colorado From: Cheyenne, Wyoming

7:49a	8:18a	FL	625	S	C5	0	
10:00a	10:27a	WA	53	Y	737	0	
10:55a	11:24a	FL	503	S	C5	0	
5:46p	6:15p	FL	523	S	C5	0	$36.00

To: Sheridan, Wyoming From: Denver, Colorado

5:45p	7:53p	WA	52	Y	737	2	$72.00

To: Denver, Colorado From: Sheridan Wyoming

8:25a	10.27a	WA	53	Y	737	2	$72.00

1972 AIRLINE SCHEDULE

To: Pierre, South Dakota From: Denver, Colorado

7:00a	10:39a	WA	470	Y	737S	2	
		CONNECTIONS					
11:30a	5:52p	FL	92	S	737S	0	
12:22p RAP	3:58p	WA	412	Y	737	0	$76.00

To: Denver, Colorado From: Pierre, South Dakota

5:10p	5:58p	WA	475	Y	737	1	$76.00

To: Bismarck, North Dakota From: Denver, Colorado

11:30a	2:19p	FL	92	S	737S	1	
8:25p	11:16p	FL	96	S	737	1	$110.00

To: Denver, Colorado From: Bismarck, North Dakota

6:25a	7:17a	FL	91	S	737S	1	
4:23p	5:10p	FL	97	S	737	1	$110.00

To: Helena, Montana From: Denver, Colorado

Flights have been discontinued

To: Denver, Colorado From: Helena, Montana

Flights have been discontinued

To: Gilette, Wyoming From: Denver, Colorado

Flights have been discontinued

To: Denver, Colorado From: Gilette, Wyoming

Flights have been discontinued

1972 AIRLINE SCHEDULE

To: Salt Lake City, Utah From: Denver, Colorado

X67	7:45a	8:51a	FL	63	S	737	B	0	
	8:00a	9:10a	WA	671	Y	737	B	0	
67	8:40a	9:46a	UA	777	F/Y	737	B	0	
	9:20a	10:26a	FL	61	S	737		0	
	9:40a	10:44a	TT	980	S	DC9		0	
	10:55a	12:00n	UA	161	F/Y	D8F		0	
	12:20p	1:30p	WA	491	Y	737	L	0	
X7	1:50p	2:56p	FL	23	S	737		0	
	2:05p	3:10p	UA	293	F/Y	727		0	
	2:30p	4:11p	FL	65	S	737		1	
	2:55p	5:37p	FL	579	S	C5		3	
	4:30p	5:35p	UA	761	F/Y	727	S	0	
	4:40p	5:45p	WA	675	F/Y	B2F	S/	0	
	6:40p	7:50p	WA	493	Y	737	D	0	
	7:10p	8:16p	FL	17	S	737		0	
	7:45p	8:50p	UA	311	F/Y	72S		0	$96.00

To: Denver, Colorado From: Salt Lake City, Utah

	7:25a	8:29a	UA	166	F/Y	72S	B	0	
	7:50a	8:54a	FL	14	S	737	B	0	
X67	9:15a	10:19a	FL	64	S	737	B	0	
	10:20a	11:24a	UA	376	F/Y	72S		0	
	10:30a	11:30a	WA	690	F/Y	72S		0	
	11:15a	12:20p	TT	981	S	DC9		0	
	11:40a	1:20p	FL	62	S	737		1	
	1:55p	3:00p	WA	490	Y	737		0	
	2:23p	5:00p	FL	578	S	C5		3	
	2:25p	3:29p	UA	964	F/Y	727		0	
67	2:50p	3:55p	UA	974	F/Y	737		0	
X7	3:30p	4:34p	FL	68	S	737		0	
	4:30p	5:34p	UA	946	F/Y	727	S	0	
	5:00p	6:04p	FL	66	S	737	S	0	
	6:15p	7:20p	WA	492	Y	737	D	0	
	8:35p	9:40p	WA	672	Y	737		0	$96.00

To: Casper, Wyoming From: Denver, Colorado

	7:00a	7:45a	WA	470	Y	737	S	0	
	10:50a	11:35a	FL	81	S	737		0	
	11:25a	12:10p	WA	56	Y	737		0	
	5:45p	6:59p	WA	52	Y	737		1	
	8:00p	8:45p	FL	87	S	737		0	$54.00

To: Denver, Colorado From: Casper, Wyoming

7:55a	8:39a	FL	80	S	737 S	0	
9:15a	10:27a	WA	53	Y	737	1	
9:44a	11:24a	FL	503	S	C5	2	
3:40p	4:24p	FL	86	S	737	0	
4:45p	5:29p	WA	57	Y	737	0	$54.00

To: Billings, Montana From: Denver, Colorado

7:00a	8:15a	WA	21	Y	737 B	0	
10:50a	12:32p	FL	81	S	737	1	
11:25a	1:14p	WA	56	Y	737	1	
5:45p	8:53p	WA	52	Y	737	3	
6:15p	7:30p	WA	54	Y	737 D	0	
8:00p	9:47p	FL	87	S	737	1	$82.00

To: Denver, Colorado From: Billings, Montana

7:00a	8:39a	FL	80	S	737 S	1	
7:45a	10:37a	WA	53	Y	737	3	
10:25a	11:37a	WA	55	Y	737	0	
2:45p	4:24p	FL	86	S	737	1	
3:40p	5:29p	WA	57	Y	737	1	
9:00p	10:12p	WA	168	Y	737	0	$82.00

GREAT FALLS TO HELENA

2:40P	3:03P

HELENA TO GREAT FALLS

2:00P	2:22P

GREAT FALLS TO DENVER

6:00A	8:39A
9:35A	11:37A
1:50P	4:24P
2:50P	5:29P
8:10P	10:12P

CONNECTIONS

4:20P	7:20P
6:00p SLC	6:15p
4:35P	7:20P
5:50p SLC	6:15p

Denver to Great Falls, Montana

7:00A	9:09A	WA	21	Y	737	B	1
10:50A	1:28P	FL	81	S	737		2
11:25A	2:09P	WA	56	Y	737		2
6:15P	8:29P	WA	54	Y	737	D	1
8:00P	10:46P	FL	87	S	737		2
		CONNECTIONS					
12:20P	3:38P	WA	491	Y	737	L	0
1:30p SLC	*1:50p*	WA	116	Y	737		1
4:30P	7:42P	UA	761	F/Y	727	S	0
5:35p SLC	*6:30p*	WA	168	Y	737	D	0
4:40P	7:42P	WA	675	F/Y	B2F	S/	0
5:45p SLC	*6:30p*	WA	168	Y	737	D	0

APPENDIX C

OPERATING COSTS MU-2G

	177,000 Mi/Yr 600 Hours	236,000 Mi/Yr 800 Hours
Average Direct Costs Per Hour		
1. Fuel (70 gal/hr @ 43¢)	$29.40	$29.40
2. Oil	.14	.14
3. Inspection, Maintenance	14.00	14.00
4. Engine Overhaul Allowance	20.00	20.00
Total Direct Cost Per Hour	$63.54	$63.54
Average Indirect Costs Per Hour		
5. Hangar	$ 5.00	$ 3.75
6. Insurance	19.17	14.38
Total Cost Per Hour	$87.71	$81.67
Cost Per Mile		
7. Average Cost Per Mile (Block @ 295 Speed)	30¢	27.6¢
8. Average Cost Per Seat Mile (8 Seats)	3.7¢	3.4¢

Computation of Average Operating Costs

NOTE: Variable costs for crew, miscellaneous trip expenses, and depreciation are not included above. These vary with each individual company and should be figured separately.

(1) The average fuel consumption of the MU-2G is based on relatively short stage lengths (500 mi.) with an operational altitude of 15,000 ft.

(2) Oil consumption includes 1 qt. per 50 hours of operation and an oil change every 800 hours. Oil price is based on $14 per gallon.

(4) Engine overhaul is based on current AiResearch overhaul price of $20,000 per engine at 2000 hours TBO.

(5) Hangar rental is $250 per month.

(6) Insurance is figured on a standard MU-2G, equipped, including electronics, $525,000 at 2%, plus $1,000.00 for two million dollar liability. All insurance quotations are based on two pilot operation, subject to individual quotations and subject to change.

estimated operating cost

	400 Hrs. 101,600 Miles/Year	600 Hrs. 152,400 Miles/Year	800 Hrs. 203,200 Miles/Year	1,000 Hrs. 254,000 Miles/Year
direct operating costs per hour				
(1) Fuel	$25.60	$25.60	$25.60	$25.60
(2) Oil	.19	.19	.19	.19
(3) Inspection, Maintenance and Propeller Overhaul	20.76	20.76	20.76	20.76
(4) Engine Exchange Allowance	14.97	14.97	14.97	14.97
Total Direct Operating Cost Per Hour	$61.52	$61.52	$61.52	$61.52
indirect operating costs				
(5) Hangar Rental	$ 5.90	$ 4.10	$ 3.20	$ 2.66
(6) Insurance	17.39	11.59	8.69	6.96
Total Indirect Operating Cost Per Hour	$23.29	$15.69	$11.89	$ 9.62
total operating cost per hour	$84.81	$77.21	$73.41	$71.14
cost per mile				
(7) Operating Cost Per Mile	33.5c	30.5c	29.0c	28.1c
(8) Cost Per Seat Mile	5.6c	5.1c	4.8c	4.7c

Depreciation allowance for tax purposes should be determined after consultation with your financial adviser.

COMPUTATION OF ESTIMATED OPERATING COSTS

(1) **FUEL.** Fuel consumption is based on operation at maximum cruise power at 21,000 feet with allowance for normal taxiing and climb to altitude. Aviation kerosene computed at 64 gallons per hour at 40¢ per gallon.

(2) **OIL.** Oil consumption includes allowance for oil change every 600 hours and is based on factory service-test consumption. Computed at 1 quart used for each 100 hours' operation plus 6.5 gallons changed each 600 hours at a cost of $14.40 per gallon.

(3) **INSPECTION, MAINTENANCE AND PROPELLER OVERHAUL** is based on all inspections and miscellaneous repairs including unscheduled parts and labor; includes one H.S.I.

(4) **ENGINE EXCHANGE ALLOWANCE** includes a reserve toward 2,400-hour engine exchange including labor and accessories.

(5) **HANGAR RENTAL** is based on a national average cost of $2,160 per year plus 50¢ per hour storage away from base.

(6) **INSURANCE.** Insurance coverage consists of full hull and $5 million single limit liability. Premiums are based on an aircraft evaluation of $510,000 ($460,150 standard airplane plus $49,850 optional equipment*) at rates obtainable under Beech Finance Plans.

(7) **OPERATING COST PER MILE** is based on an average speed of 253 miles-per-hour (220 kts.)

(8) **TOTAL COST PER SEAT MILE** is based on an average utilization of 6 seats.

*Average optional equipment installation.

tax savings cut costs

Ownership of a Beechcraft King Air C90 will substantially reduce your income tax expense. Much of the reduction can come in the early years, allowing you to return the taxes saved to your business.

The tax benefits of ownership directly reduce the cost of your aircraft. To illustrate how, let's assume (1) that your taxable income is subject to a 52% tax rate (Federal and State), (2) that you purchase this aircraft fully equipped for $510,000 and (3) that you elect to depreciate the aircraft over five years on the double declining balance method.

Year	Depreciable Base	Depreciation Rate	Depreciation Expense	Tax Savings
1	$510,000	40%	$204,000	$106,080
2	306,000	40%	122,400	63,648
3	183,600	40%	73,440	38,189
4	110,160	40%	44,064	22,913
5	66,096	40%	26,438	13,748
Totals			$470,342	$244,578

*Residual Book Value $39,658 (Assumed to equal market for illustration purposes.)

Purchase price of King Air C90		$510,000
Less: Investment tax credit (4 2/3%)	$ 23,800	
Tax savings on depreciation	244,578	268,378
Cost after five years		241,622
Less selling price * of aircraft		39,658
Cost of aircraft after tax savings		$201,964
Savings of time and costs resulting from ownership (insert your own figure)	$	
Less 52% of above		
After-tax savings from ownership	$	
Less cost of aircraft after tax savings		$201,964
Savings brought about by ownership (after tax)	$	

NOTE: A larger part of the savings occurs in the first years of ownership because of the tax advantage in those years. Your tax advisor may suggest other options to fit your situation which will lower your cost even more. A seven year depreciable life, for instance, allows the full 7% investment tax credit, reducing the $201,964 to $190,064, and he may recommend switching to a straight line method after a few years for a lower residual value.

All prices and data contained herein are subject to change without notice.

Beechcraft

Beechcraft airplanes are manufactured by the

BEECH AIRCRAFT CORPORATION

Wichita, Kansas 67201, U. S. A.

Printed in U.S.A. 72 PLOCTS C90/A

C-2

	186,000 Mi/Yr	248,000 Mi/Yr
Average Direct Costs Per Hour	600 Hours	800 Hours
1. Fuel (70 gal/hr @ 43¢)	$29.40	$29.40
2. Oil	.14	.14
3. Inspection, Maintenance	14.00	14.00
4. Engine Overhaul Allowance	20.00	20.00
Total Direct Cost Per Hour	$63.54	$63.54
Average Indirect Costs Per Hour		
5. Hangar	$ 5.00	$ 3.75
6. Insurance	16.66	12.50
Total Cost Per Hour	$85.20	$79.79
Cost Per Mile		
7. Average Cost Per Mile (Block @ 310 Speed)	27¢	25.7¢
8. Average Cost Per Seat Mile (7 Seats)	3.9¢	3.7¢

Computation of Average Operating Costs

NOTE: Variable costs for crew, miscellaneous trip expenses, and depreciation are not included above. These vary with each individual company and should be figured separately.

(1) The average fuel consumption of the MU-2F is based on relatively short stage lengths (500 mi.) with an operational altitude of 15,000 ft.

(2) Oil consumption includes 1 qt. per 50 hours of operation and an oil change every 800 hours. Oil price is based on $14 per gallon.

(4) Engine overhaul is based on current AiResearch overhaul price of $20,000 per engine at 2000 hours TBO.

(5) Hangar rental is $250 per month.

(6) Insurance is figured on a standard MU-2F, equipped, including electronics, $450,000 at 2%, plus $1,000.00 for two million dollar liability. All insurance quotations are based on two pilot operation, subject to individual quotations and subject to change.

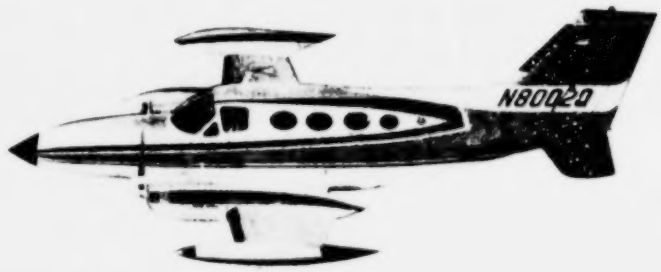
GUIDE FOR ESTIMATING

COST OF OPERATION

COMPUTED FROM NATIONAL AVERAGES BY THE CESSNA AIRCRAFT COMPANY, WICHITA, KANSAS

CESSNA

421 GOLDEN EAGLE



	*PER YEAR	PER YEAR	*PER HOUR	PER HOUR	PER HOUR	PER HOUR
FLIGHT HOURS PER YEAR				300	500	700
FLIGHT MILES PER YEAR: 240 mph, 65% power at 20,000 ft., Normal Lean Mixture				72,000	120,000	168,000
GASOLINE: 37.5 gal./hr. at 50¢/gal				$18.75	$18.75	$18.75
OIL: 1 qt./hr. per engine plus oil change every 50 hrs. (13 qts. per change) at 70¢/qt				$ 1.05	$ 1.05	$ 1.05
AIRPLANE & ENGINE MAINTENANCE				$ 7.25	$ 7.25	$ 7.25
TOTAL OPERATIONAL COSTS (listed above)				$27.05	$27.05	$27.05
RESERVE FOR ENGINE OVERHAUL				$ 8.88	$ 8.88	$ 8.88
STORAGE: at $150.00 per month		$1,800		$ 6.00	$ 3.60	$ 2.57
INSURANCE (a guide for the following coverage): All risks hull coverage						
No Deductibles		$5,420				
Liability Coverage $1,000,000.00 single limit		$ 225				
TOTAL INSURANCE (Industrial private business & pleasure use by a qualified pilot)		$5,645		$18.81	$11.29	$ 8.06
COST PER HOUR				$60.74	$50.82	$46.56
COST PER MILE: 65% power, 240 mph				$ .253	$ .212	$ .194
COST PER SEAT MILE: 8 People				$ .032	$ .026	$ .024

FOR DEPRECIATION: Consult your tax authority. To estimate the per hour or per mile cost, divide annual depreciation amount by annual hours or miles.

*YOUR COSTS: No doubt vary from these national averages. This column is included for you to compute your estimate of your hours, miles and costs.

Reserve for engine overhaul is estimated at $4.44 per hour per engine. If an engine exchange is preferred, it should be estimated at $5.92 per hour per engine, based on a remanufactured exchange engine at the recommended overhaul hours.

GUIDE FOR ESTIMATING

COST OF OPERATION

COMPUTED FROM NATIONAL AVERAGES BY THE CESSNA AIRCRAFT COMPANY, WICHITA, KANSAS

CESSNA

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	*PER YEAR	PER YEAR	*PER HOUR	PER HOUR	PER HOUR	PER HOUR
FLIGHT HOURS PER YEAR				300	500	700
FLIGHT MILES PER YEAR: 224 mph, 65% power at 20,000 ft., Normal Lean Mixture				67,200	112,000	156,800
GASOLINE: 29.7 gal./hr. at 50¢/gal.				$14.85	$14.85	$14.85
OIL: 1 pt./hr. per engine plus oil change every 50 hrs. (13 qts. per change) at 70¢/qt.				$ 1.05	$ 1.05	$ 1.05
AIRPLANE & ENGINE MAINTENANCE				$ 7.00	$ 7.00	$ 7.00
TOTAL OPERATIONAL COSTS (listed above)				$22.90	$22.90	$22.90
RESERVE FOR ENGINE OVERHAUL				$ 6.32	$ 6.32	$ 6.32
STORAGE: at $150.00 per month		$1,800		$ 6.00	$ 3.60	$ 2.57
INSURANCE (a guide for the following coverage): All risks hull coverage						
No Deductibles		$3,728				
Liability Coverage $1,000,000.00 single limit		$ 225				
TOTAL INSURANCE (Industrial private business & pleasure use by a qualified pilot)		$3,953		$13.18	$ 7.91	$ 5.65
COST PER HOUR				$48.40	$40.73	$37.44
COST PER MILE: 65% power, 224 mph				$ .216	$ .182	$ .167
COST PER SEAT MILE: 7 People				$ .031	$ .026	$ .024

FOR DEPRECIATION: Consult your tax authority. To estimate the per hour or per mile cost, divide annual depreciation amount by annual hours or miles.

*YOUR COSTS: No doubt vary from these national averages. This column is included for you to compute your estimate of your hours, miles and costs.

Reserve for engine overhaul is estimated at $3.16 per hour per engine. If an engine exchange is preferred, it should be estimated at $4.21 per hour per engine, based on a remanufactured exchange engine at the recommended overhaul hours.

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APPENDIX D

AIRCRAFT OPERATION SERIES[1]

Airplane Pilot
Helicopter Pilot
Aircraft Pilot
Flight Instructor (Fixed Wing)
Flight Instructor (Helicopter)
Flight Instructor (Aircraft)
Flight Test Pilot
Airspace System Inspection Pilot
Navigator
Flight Engineer

DESCRIPTION OF WORK

Airplane Pilot—Helicopter Pilot—Aircraft Pilot

Pilots light or heavy, single or multiengine airplanes, helicopters, or both. The work involves, for example, transporting passengers, freight and supplies; performing reconnaissance, survey and patrol assignments; dropping cargo and smokejumpers; or taking wild game censuses. The duties of these positions are performed day and night over all kinds of terrain and in any weather. Specific certificates and instrument flight ratings required depend upon the requirements of specific positions.

Flight Instructor (Fixed Wing)—Flight Instructor (Helicopter)—Flight Instructor (Aircraft)

Serves as instructor pilot in various models of helicopters or airplanes. Helicopter instruction includes, for example: Taxiing, hovering, climbing turns, normal and steep approaches and running landings and takeoffs day or night under visual or instrument flight rules or both. Fixed wing instruction includes, for example: Normal and short-field takeoffs and landings; flight formations; and aerobatics both day and night under visual or instrument flight rules or both. Specific certificates and instrument flight ratings required depend upon the requirements of specific positions. Staff positions involve planning, development, execution, and evaluation of flight instruction programs.

[1] This standard supersedes the X-118 standard for this series which was issued in May 1964 and the single-agency standard which was issued in January 1965.

Flight Test Pilot

Administers regulations relating to the airworthiness of aircraft through the inspection, flight testing, and evaluation of the flight performance, powerplant operation, and flight characteristics of aircraft (prototype or modified) and of aircraft components presented for type certification. Supervises the activities of designated flight test representatives and participates in the investigation of accidents and violations of regulations. Staff positions involve planning, development, execution, and evaluation of flight test programs.

Airspace System Inspection Pilot

Persons appointed to these positions conduct in-flight inspections of existing and experimental air navigation facilities for the purpose of determining space radiation patterns, modulation levels (both RF and Audio), interference with transmissions and responses of aids to air navigation and air traffic control, signal strength, and rate of return and intelligibility of transmitted information. From an analysis of the data derived from such inspection they determine the adherence to prescribed tolerances, safety and practicability of flight procedures based on air navigation and air traffic control facilities, and overall adequacy of such aids. They pilot multiengine aircraft specially equipped as flying electronic laboratories on day and night flights, both on and off established airways under visual and instrument flight conditions, recording and analyzing facility performance, and reporting on the operation of aids to navigation, and potential hazards to air navigation. They assist in accident investigations by making special flight tests of any facilities concerned; and maintain liaison with aviation interests regarding the installation, operation and use of air navigation facilities. Staff positions involve planning, development, execution, and evaluation of airspace system inspection programs.

Navigator

Navigators perform such work as: Preparing flight plans; checking serviceability of naviga-

tional systems: making computations and furnishing the pilot with such information as heading, groundspeed, airspeed, estimated time of arrival and position of aircraft; and maintaining flight logs. Work is performed as a member of the flight crew under the direction of the pilot.

Flight Engineer

Flight Engineers perform such work as: Computing takeoff and flight performance data; planning fuel flow and adjusting and setting mixture controls; operating and synchronizing engines; setting pitch control on propeller aircraft; observing and analyzing instrument readings; and operating pressurization, hydraulic and electrical systems. Work is performed as a member of the flight crew under flight operating procedures and at the direction of the pilot.

EXPERIENCE, TRAINING AND OTHER REQUIREMENTS

To be eligible for a position in this series, the applicant must possess the flying time, certificates, and ratings required for that position. Except to the extent defined below, this standard does not require a specified number of years of experience.

Airplane Pilot
Helicopter Pilot
Aircraft Pilot
Airspace System Inspection Pilot

Grade	Total time (hours)	Pilot-in-command (hours)	Multiengine (hours)	Instrument/night (hours)	Last 12 months (hours)
GS–9	1200	250	100	100	100
GS–11/15	1500	250	300	150	100

Certificates and ratings

For all grades and specializations, applicants must hold a valid Commercial Pilot Certificate.

a. Applicants for the Airspace System Inspection Pilot specialization must hold, in addition, multiengine land and instrument ratings.

b. For positions in the Airplane Pilot, Helicopter Pilot and Aircraft Pilot specializations, rating requirements depend on position requirements. For example, some positions require instrument ratings, but not multiengine ratings, while others require both and still others require neither. Specific ratings for specific positions must be identified through position analyses.

Quantity and type of experience

All applicants must meet the pilot-in-command, last 12 months, and total time requirements. Applicants for positions that require multiengine ratings, or instrument ratings, or both, must also possess the hours required under the heading or headings appropriate to those ratings. Applicants for positions that do not require instrument ratings are not required to possess the instrument time, and applicants for positions that do not require multiengine ratings are not required to possess the multiengine time. Similarly, applicants for positions that do not require either instrument or multiengine ratings are not required to possess either instrument or multiengine time.

a. Flying time in any of the above categories may have been acquired in aircraft of any weight, *except* that in those specializations or positions at GS–11 and above which require operation of heavy multiengine aircraft at least 50 percent of the multiengine time must have been in multiengine aircraft with a gross weight of over 12,500 pounds.

b. Flying time in any of the above categories may have been acquired as pilot-in-command or copilot, *except* the pilot-in-command hours specifically required.

c. Instrument or night time must include at least 40 hours of actual instrument weather time. The balance of this column may have been acquired entirely in either category, or any combination thereof, and may include other types of instrument time.

d. Each hour as pilot-in-command of jet air-

[1] See footnote on page 1.

craft may be counted as 2½ hours of flying time. To be creditable as multiengine time, this type of flying must have been acquired in multiengine jet aircraft. A maximum of 300 hours of this time may be used in this manner toward meeting 750 hours of the flight time requirements. *This special credit is not permitted, however, for the instrument/night time required, nor for the 100 hours of flying time required within the past year.*

Substitution for recency

One year of experience listed below which was acquired within the most recent year may be substituted for not more than 50 hours of the 100 hours of flying time required within the last 12 months.

A. *For all positions and specializations—*

1. Chief Pilot of an airline or of an FAA certificated flight school.
2. Designated Pilot Examiner or Instrument Rating Examiner.
3. Chief Test Pilot supervising experimental type aircraft testing with a factory or an airline.
4. Designated Airline Transport Pilot Certificate Examiner.
5. Supervisor of flight operations with an airline.

B. *For FAA positions and specializations, in addition to A above—*

1. Experience as a certificated air traffic controller, civil or military, individually responsible for formulating and issuing clearances to IFR air traffic.
2. Experience in the FAA as a Pilot, Inspector, or Specialist in the Airspace Systems Inspection, Flight Test, Air Carrier Operations, or General Aviation Operations programs; as a flight check data reduction, analysis and evaluation specialist; or as an instructor, supervisory instructor or training specialist conducting training in Airspace System Inspection.

Flight Test Pilot

Grade	Total time (hours)	Pilot-in-command (hours)	Last 12 months (hours)
GS-9	1500	1000	100
GS-11/15	1750	1150	100

Certificates and ratings

For all grades, applicants must hold a valid Commercial Pilot Certificate with single-engine land, multiengine land, and instrument ratings. For positions which also involve operation of helicopters applicants must possess certificates and ratings for helicopters appropriate to the requirements of the positions.

Quantity and type of experience

a. Flying time in any of the above categories may have been acquired in aircraft of any weight.

b. Flying time in any of the above categories may have been acquired as pilot-in-command or copilot *except* (1) the pilot-in-command hours specifically required, and (2) the 100 hours recent time must include at least 65 hours as pilot-in-command.

c. Each hour as pilot-in-command of jet-powered, rocket-powered or other specialized types of aircraft may be counted as 2½ hours of flying time. A maximum of 300 hours of specialized flying time may be used in this manner toward meeting 750 hours of the flight time requirements. *This special credit is not permitted, however, for the 100 hours of flying time required within the past year.*

Substitutions for recency

One year of experience listed below which was acquired within the most recent year may be substituted for the 100 hours of flying time required within the last 12 months.

A. *For positions in all agencies—*

Chief Test Pilot with a factory or airline supervising experimental type aircraft testing.

[1] See footnote on page 1.

B. *For positions in the FAA, in addition to A above*–

1. FAA Pilot, Inspector or Specialist in in Flight Test, Air Carrier Operations, General Aviation Operations, or Airspace System Inspections.
2. FAA Instructor, Supervisory Instructor or Training Specialist conducting or providing training in the engineering flight testing of aircraft.

Flight Instructor (Fixed Wing)
Flight Instructor (Helicopter)
Flight Instructor (Aircraft)

Grade	Total time (hours)	Instructor time (hours)	Last 12 months (hours)
GS-9	1000	250	50
GS-11/15	1500	500	100

Certificates and ratings

Applicants for all positions must hold a valid Commercial Pilot Certificate and a Flight Instructor Certificate for the class of aircraft appropriate for the specialization, e.g., fixed-wing, helicopter, or both. Depending on the specific requirements of the position, applicants may be required to possess, in addition, instrument ratings. In those situations, the flight instructor's time must have been as an instrument flight instructor.

Quantity and type of experience

The instructor time must have been in the aircraft appropriate for the specialization, e.g., fixed-wing, helicopter, or both, in whatever combination is appropriate.

Substitution for recency

One year of experience listed below which was acquired within the most recent year may be substituted for 50 of the hours of flying time required within the last 12 months.

1. Experience as an Instructor, Supervisory Instructor or Training Specialist conducting or providing training in the field of flight instruction or flight testing of airmen.
2. Experience as a designated Pilot Examiner or Instrument Rating Examiner.
3. Experience as a designated Airline Transport Pilot Certificate Examiner.

Navigator and Flight Engineer

Grade	Years of experience		Total (years)
	General	Specialized	
GS-5	3	0	3
GS-7	3	1	4
GS-9	3	2	5
GS-11 & above	3	3	6

General experience

Navigator and Flight Engineer.—Trade, craft, technical, administrative, or professional experience which provided applicant with a working knowledge of the specialization for which application is made. For example, experience as a mechanic with responsibility for overhaul and repair of navigational or other aircraft systems or experience as an electronic technician with responsibility for the aircraft systems appropriate to the specialization.

Specialized experience

For Navigator.—Experience which provided the applicant with:

a. Knowledge of flight plan requirement;
b. Skill in using navigational computers, conversion charts, and flight planning reference data;
c. Ability to recognize celestial bodies for navigation use;
d. Knowledge of electronic navigational systems and aircraft characteristics;
e. Ability to determine the location of the aircraft by navigational computations; and
f. As required, ability to use high altitude, polar and constant pressure techniques.

For Flight Engineer.—Experience which provided the applicant with:

a. Knowledge of loading, airplane systems, emergency procedures, and computations of fuel consumption;

[1] See footnote on page 1.

b. Skill to perform preflight inspection, in-flight operation of assigned systems, and emergency duties required, for example, in engine failure;
c. Ability to take and interpret instrument readings and make control adjustments and settings;
d. Knowledge of operating characteristics of aircraft engines and systems; and
e. Knowledge of flight procedures and sequences specific to flight control panel operation.

LEVEL AND QUANTITY AND QUALITY OF EXPERIENCE

For eligibility at each grade through GS-11, the applicant must have had at least 6 months of experience comparable in level of difficulty and responsibility to that of the next lower grade, or 1 year of experience comparable in level of difficulty and responsibility to that of the second lower grade in the Federal Service. For eligibility at grades GS-12 and above, the applicant must have had at least 1 year of experience comparable in level of difficulty and responsibility to that of the next lower grade in the Federal service.

Quality of experience

For each grade through GS-11, the amount of experience required in the immediately preceding paragraph may have been either *Acceptable Experience* or *Preferred Experience* as defined below. For grades GS-12 and above, the experience must have been *Preferred Experience.*

Acceptable Experience: For all specializations, experience as a pilot or copilot in general, air carrier or military aviation.

Preferred Experience: Experience as a pilot or copilot which provided a thorough knowledge of the guidelines, procedures, regulations, laws, policies and purposes of the program within which the position functions. Illustrations of the kinds of knowledges and programs referred to are provided below by specialization.

A. *Airplane, Helicopter and Aircraft Pilot.*—Positions in these specializations function within programs such as:
1. Scientific exploration or geological survey programs and require a thorough knowledge of reconnaissance, survey and patrol assignments;
2. Fire control programs which require, for example, a thorough knowledge of dropping cargo and smokejumpers;
3. Game-law enforcement programs which require, for example, the knowledge and ability to take wild game censuses;
4. Border patrol programs which require, for example, the knowledge and ability to search for signs of illegal border crossings and to trace aliens.

The program knowledges are those appropriate to the position. For example, a position in the border patrol program does not require knowledge of the geological survey program.

B. *Airspace System Inspection Pilot.*—Experience for positions in this specialization must have provided a thorough knowledge of the operation, inspection and evaluation of radio aids to air navigation; the investigations and analyses made for the purpose of determining the adequacy of existing and experimental air navigation aids and associated flight procedures; and how to analyze and evaluate facility flight inspection performance and operation data.

C. *Flight Test Pilot Specialization.*—Experience for positions in this specialization must have included one of the following: (1) flight testing aircraft for type certification; (2) analyzing aircraft performance data; or (3) successful completion of a recognized Flight Test Pilot course of at least 6 months' duration such as a military Flight Test School or the FAA Flight Test Pilot course.

[1] See footnote on page 1.

D. *Flight Instruction Specializations.*—Experience for positions in these specializations must have provided a thorough knowledge of the methods, techniques and principles of classroom and in-flight instructing and examining.

BASIS OF RATING

No written test is required. Applicant's qualifications will be rated on a scale of 100, based on an evaluation of the quality of the applicant's experience, education and training in relation to the requirements of the position. Ratings will be based on information contained in the applicant's applications and on other evidence which may be obtained.

EXCEPTIONS TO RECENCY REQUIREMENTS

Recency requirements may be waived for candidates or for occupants of staff specialist positions which require pilot knowledges, skills, and abilities but which do not require actual aircraft operation, provided the applicant or candidate otherwise qualifies for the position.

PHYSICAL REQUIREMENTS

At the time of initial appointment, applicants for all pilot positions must possess a currently valid first-class medical certificate in accordance with the regulations of the FAA. Navigators and Flight Engineers must possess a second-class FAA medical certificate. Staff specialists who do not participate in the operation of the aircraft need have only a CSC SF-78 (Certificate of Medical Examination), indicating they are able to perform the duties of their particular job.

Acceptability of medical certificates

To comply with Civil Service Commission regulations, the medical certificate held by the applicant must not be more than 60 days old as of the date a selection is made to fill a position, or as of the date a certificate of eligibles is received from a certifying office. However, to avoid unnecessary expense to applicants, persons who possess a *currently valid* first- or second-class medical certificate which is more than 60 days old need not be required to take another first- or second-class medical examination. Instead, a standard CSC SF-78 (Certificate of Medical Examination) may be accepted in lieu of a new first- or second-class medical certificate, provided the SF-78 medical itself is not more than 60 days old, and also provided that the requirements of the Federal Personnel Manual are observed.

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[1] See footnote on page 1.

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APPENDIX E

Airplane Pilot GS-11
Helicopter Pilot GS-11
Aircraft Pilot GS-11
Flight Instructor (Fixed Wing) GS-11
Flight Instructor (Helicopter) GS-11
Flight Instructor (Aircraft) GS-11

GS-2181-11

Assignments characteristic of the GS–11 level involve application of the knowledges, skills, and abilities required:

—To instruct or evaluate students in the basic techniques involved in flying light single or twin engine airplanes or helicopters under visual flight rules.

—To fly light single or twin engine airplanes or helicopters over unfavorable terrain, e.g., mountains, forest, or deserts with responsibility for operating from confined or isolated areas primarily in clear weather.

—To fly light single or twin engine airplanes or helicopters along established airways with responsibility for carrying passengers to and from a few points which are familiar.

Flight instruction assignments at the GS–11 level are characterized by a marked degree of hazard and involve training or evaluating student pilots in the basic techniques of flying one or two models of light single or twin engine airplanes or one or two models of helicopters under visual flight rules. The basic techniques are those required to operate from runways of sufficient size for the aircraft under favorable weather conditions with no load beyond the minimum required, e.g., fuel. GS–11 assignments include responsibility for conducting ground classes from prepared lesson plans; grading students; describing students' performance and progress; and recommending continuation of students' training or their elimination from the training course.

Another GS–11 assignment characterized by a marked degree of hazard involves flying light single or twin engine airplanes or helicopters over unfavorable terrain such as mountains, forests or deserts with responsibility for operating from landing strips which are restricted in size or are in isolated areas or both. For the most part, this kind of assignment is performed in the daytime under favorable weather conditions for such purposes as delivering supplies or freight.

GS-2181-11 GS-2181-11

Assignments to transport passengers at the GS–11 level are characterized by a minimum degree of hazard and involve flying light single or twin engine airplanes or helicopters to and from the same few points. Assignments at this level do not require flying to unfamiliar destinations, or operating in severe weather. Flying routinely to the same few destinations is characteristic of the GS–11 level because the pilot needs to learn the characteristics, e.g., charts, navigational facilities and geography, of only a few airports.

GS-2181-12 GS-2181-12

Airplane Pilot GS–12
Helicopter Pilot GS–12
Aircraft Pilot GS–12
Flight Instructor (Fixed Wing) GS–12
Flight Instructor (Helicopter) GS–12
Flight Instructor (Aircraft) GS–12

Assignments characteristic of the GS–12 level involve application of the knowledges, skills, and abilities required:

—To instruct or evaluate students in the flight techniques required to fly tactical operations such as short-field takeoffs and landings, flight formations, or aerobatics in light, single or twin engine airplanes or helicopters under visual flight rules.

—To fly light single or twin engine airplanes or helicopters at low altitudes and speeds over unfavorable terrain with responsibility for making patrols and operating from confined or isolated areas.

—To fly light single or twin engine airplanes or helicopters along established airways with responsibility for transporting passengers to and from a variety of different points some of which are unfamiliar.

—To conduct test programs of airplane or helicopter communication or navigational systems when the systems tested do not materially affect the performance of the aircraft.

Flight instructor assignments at the GS–12 level are characterized by a substantial degree of hazard and involve training

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or evaluating students in the advanced techniques required, for example, in short-field takeoffs and landings under maximum loads, flying in formation, performing evasive maneuvers, and aerobatics. Students are taught the procedures to use in emergencies such as engine failures and malfunctions of hydraulic and electrical systems over rough terrain, e.g., hills and forests both day and night. Assignments at this level include responsibility for reviewing students' basic training and determining their ability to progress into these advanced courses; determining through evaluation rides if students should be continued or eliminated; and recommending elimination of students whose progress is unsatisfactory. Responsibility for training or evaluating students in the basics of instrument flight, e.g., teaching through demonstration, will not remove a position from the GS–12 level. Assignments at this level are distinguished from those at the GS–11 level primarily in that very advanced techniques are taught at this level.

Assignments which involve flying at minimum speeds or altitudes or both over unfavorable terrain are characterized by a substantial degree of hazard and are for the purpose of, for example, observing tracks and signs made by aliens entering the United States illegally; tracking game; determining how well equipment for spraying insecticides functions; spotting and observing forest fires; or making patrols of powerlines to identify and inspect maintenance problems. Often these assignments involve making flights over uncharted courses and using meadows or roads for landing strips. These assignments are distinguished from the GS–11 level by the greater degree of skill and judgment required to fly at low altitudes over unfavorable terrain. Flying low in desert heat is difficult, for example, because air currents vary at that temperature making aircraft behave unpredictably. An additional factor of difficulty is that the pilot is directing his attention outside the airplane for a sustained period of time. Moreover, at low altitudes there is little chance to maneuver to a favorable landing site in the event of trouble.

Assignments to transport passengers at the GS–12 level are characterized by a minimum degree of hazard and involve flying a variety of light twin engine airplanes or helicopters to and from

a variety of locations. Flying to a variety of different locations is an added difficulty over the GS-11 level because for each different location the pilot must become familiar with, for example, new charts, radio frequencies, and topographical and geographical features. These flights are made both day and night and require skill in instrument flight techniques. Except for unpredicted storms, these flights are made under favorable weather conditions.

Test work at the GS-12 level is characterized by a minimum degree of hazard and involves, for example, conducting flight tests of communications or navigation equipment. These assignments require a technical knowledge of the operation capabilities and purposes of the equipment tested.

GS-2181-13

Airplane Pilot GS-13
Helicopter Pilot GS-13
Aircraft Pilot GS-13
Flight Instructor (Fixed Wing) GS-13
Flight Instructor (Helicopter) GS-13
Flight Instructor (Aircraft) GS-13
Airspace System Inspection Pilot GS-13
Flight Test Pilot GS-13

GS-2181-13

Assignments characteristic of the GS-13 level involve application of the knowledges, skills, and abilities required:

--To instruct or evaluate student or rated pilots in advanced instrument flight technique; to instruct fixed or rotary wing pilots in methods of instruction and evaluate their proficiency to engage in flight instruction; to perform special projects involving a comparable responsibility and skill; or various combinations of these.

—To fly heavy twin or multiengine aircraft equipped with electronic devices used to inspect air navigational facilities, and to evaluate the safety and practicability of terminal and enroute flight procedures.

—To fly heavy twin or multiengine airplanes on extended flights with responsibility for transporting passengers to and from a wide variety of domestic or foreign points.

—To test aircraft with substantially modified or repaired systems.

Instrument flight instructor assignments at the GS–13 level are characterized by a substantial degree of hazard and involve teaching or evaluating students in the technique of operating aircraft through reference to instruments rather than through visual reference to the terrain and horizon. Included, for example, is training in instrument flight navigation; and the use of automatic direction finding equipment, omnidirectional ranges, ground control approach and instrument landing systems. Students are also taught emergency procedures used in, for example, missed approaches and radio failure. These instructors plan, schedule and conduct cross-country training flights which require reliance on precision instrument flight techniques because they involve flying along the Federal airways. As at lower levels these instructors grade and evaluate their students.

Other flight instructor assignments at the GS–13 level which are characterized by a substantial degree of hazard involve training rated pilots in methods of instruction. Assignments which involve training other instructors include, in addition to the in-flight examination of other instructors, monitoring classroom instruction to evaluate other instructors' techniques and procedures; checking instructors' grade books to train them in correct grade-book procedures; formulating lesson plans and instructional material used in classrooms; and revising methods of instruction and other training procedures in use.

GS–13 flight instructors who perform special projects write lesson plans; review, revise and develop training texts and evaluation material; and originate new material pertaining to flight training such as that needed to instruct in new equipment and procedures. These flight instructors maintain records and compile reports concerning the results of special projects. They evaluate courses of instruction for ways of improvement and for adjustment of the course to meet revised training needs. Actual aircraft operation in these assignments is relatively limited and so is the degree of hazard involved. That lack is offset by the extremely high degree of knowledge the incumbent must have of the total

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program in which he works and the characteristics of a variety of aircraft and related equipment.

Assignments that involve extended domestic or overseas flights to a wide variety of different points involve a minimum degree of hazard but are made in any kind of weather and, therefore, require a thorough knowledge of meteorology and the ability to forecast weather enroute and at points of destination; and a complete knowledge of navigational aids, publications and pertinent air traffic control procedures and regulations in a wide variety of areas. These assignments are distinguished from similar work at the GS-12 level primarily by the weight of aircraft flown and by the variety of different areas and destinations to which flights are made.

Assignments to conduct in-flight inspection of air navigational aids are characterized by a substantial degree of hazard and involve the evaluation of air navigational aids for the purpose of securing engineering data and complete information on facility performance; determining conformance to operational standards; and verifying facility integrity. These evaluations, conducted both day and night under visual or instrument conditions, require flight at low altitudes, often over hazardous terrain, and for prolonged periods in high traffic density terminal areas. The air navigational facilities inspected include but are not restricted to: Instrument landing systems; airport surveillance radar; very high frequency omnidirectional ranges; distance measuring systems; radio homing beacons; radio markers; low, medium, very high and ultrahigh frequency air/ground communications systems used in the control of air traffic; and ultrahigh and very high frequency direction finders associated with radar or air/ground communications facilities.

Assignments that involve inspecting air navigation aids require a complete knowledge of: the development of instrument flight procedures and how they serve the public with respect to users and many different kinds of aircraft; many types of navigational aid equipment; and the flight inspection equipment used. These assignments require the ability to: position the aircraft under visual or instrument flight rules with extreme precision in order

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to observe, record, and evaluate the accuracy, adequacy, and reliability of air navigation aids; determine facility performance while in flight through the analysis of analog recordings and digital equipment readout; evaluate the safety and practicability of flight procedures which are used in air traffic movement; and apply sound judgment in making reliable decisions with respect to restrictions of use or removal from service of air navigational aids.

Assignments that involve development of terminal and enroute flight procedures and evaluation of proposed changes to the airspace system through in-flight evaluation and analysis of data are characterized by a minimum degree of hazard. These assignments include: development, maintenance, and revision of IFR flight procedures which involve evaluation of such factors as facility performance; the nature and extent of interference from physical obstructions; controlled air space and communications in accordance with and against applicable regulations, standards and criteria; amendment of appropriate regulations and aeronautical publications to authorize operational use of IFR flight procedures; testifying as an expert witness at formal and informal hearings concerning regulations and instrument flight procedures; determining the need for new air navigation aids to resolve safety problems and improve operational capabilities; and evaluating the effect of proposed instructions, altered or deactivated airports, and revisions to controlled air space as it affects flight operations.

Assignments that involve development of instrument approach procedures require a complete knowledge of appropriate and controlling regulations, policies, and criteria; air carrier and general aviation operations with particular emphasis on pilot limitations; air navigation facilities and lighting aids with particular emphasis on their advantages and limitations; and aircraft limitations and capabilities. These assignments require the ability to evaluate complex flight operations and apply existing regulations, policies and criteria without jeopardizing safety; and the ability to deal successfully with members of industry.

Assignments that involve testing aircraft with substantially modified or repaired systems are characterized by a substantial

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degree of hazard and require the application of a very high degree of skill in determining aircraft performance and flight characteristics under critcal flight conditions of loading, speed and maneuvers. Substantial modifications or repairs are those which are significant enough to influence the flight characteristics of the aircraft to a pronounced degree. These assignments are performed, for example, to substantiate a valid time between overhaul of components or systems by flying beyond overhaul life cycles; or to certify aircraft as airworthy after substantial repairs or modifications. They require an exceptionally wide background of experience and training to evaluate aircraft operational procedures and mechanical deficiences and recommend new procedures or corrective action. Assignments involve compiling reports on the suitability, functions, and general practicability of aircraft and components or systems.